PROVISIONAL SUNSPOT RELATIVE NUMBERS FOR NOVEMBER 1938

(Dependent alone on observations at Zurich and its station at Arosa)

[Data furnished through the courtesy of Prof. W. Brunner, Eidgen. Sternwarte, Zurich, Switzerland]

November 1938	Relative Numbers	November 1938	Relative Numbers	November 1938	Relative Numbers
1	*a* 146	11	*a* 125	21	78
2		12	*EEccd* 134	22	56
3	*a* 162	13	*Macd* 152	23	*d* 61
4	*aad* 128	14	152	24	*Mc* 79
5	112	15	*a* 161	25	*Ec* 94
6	*Mcd* 167	16	*Eac* 157	26	*a* 85
7	*d* 176	17		27	110
8	159	18	*aa* 115	28	*ab* 107
9	138	19	*a* 106	29	
10	*b* 131	20	97	30	95

Mean: 27 days=121.6

		h m	h m
Nov. 10.	Middle large, bright chromospheric eruption	13 35–	13 50, M.
13.	Middle large, bright chromospheric eruption	13 38–	14 40, W.
20.	Middle large, bright chromospheric eruption	13 45–	14 00, W.
25.	Middle large, bright chromospheric eruption	8 50–	9 00, &
		13 55–	14 50, E.
27.	Middle large, bright chromospheric eruption	9 40–	10. 05.
28.	Middle large, bright chromospheric eruption	13 30–	14 30.

a=Passage of an average-sized group through the central meridian.
b=Passage of a large group or spot through the central meridian.
c=New formation of a group developing into a middle-sized or large center of activity: E, on the eastern part of the sun's disk; W, on the western part; M, in the central circle zone.
d=Entrance of a large or average-sized center of activity on the east limb.

AEROLOGICAL OBSERVATIONS

[Aerological Division, D. M. LITTLE in charge]

By B. FRANCIS DASHIELL

During November 1938 a total of 474 airplane and radiosonde observations were made in the United States, and the mean free-air data based on these observations, shown in tables 1 and 1a, includes pressure, temperature, and relative humidity recorded at certain geometric heights. Of all radiosonde ascensions launched at stations making such observations, about 30 percent reached a height of 19 kilometers.

The "means" are omitted from the tables whenever less than 15 observations are made at the surface and less than 5 at a standard height, but 15 observations are required for those levels which fall within the limits of the monthly vertical range of the tropopause. A description of the methods used for computing these means will be found in the January 1938 MONTHLY WEATHER REVIEW.

Chart I, published elsewhere in this REVIEW, shows the departures of the mean *surface* temperature (° F.) from normal. The month of November was warm over the entire country east of the Mississippi River valley. In that area positive departures ranged from 2° F. to 6° F. over the Great Lakes region and the Middle Atlantic coast. The weather was cool over the western half of the United States, except along the southern California coast. There the mean temperature remained close to normal. Subnormal temperatures with deficiencies ranging from 3° F. to 6° F. occurred over portions of the central Rocky Mountain States.

Mean free-air temperatures (° C.) *above* the surface (tables 1 and 1a) were rather evenly distributed in all levels below 5 kilometers. During November, however, the coldest weather was centered over the north-central States. In this area, upward from 0.5 to 11 kilometers, Fargo, N. Dak., reported the lowest temperatures recorded at each level. However, radiosonde observations made farther south, at Omaha, Nebr., and Oklahoma City, Okla., above 11 kilometers, indicated decidedly lower temperatures than those reported at Fargo, N. Dak. This fact was particularly noticeable at 17 kilometers, where the mean temperature was 13.0° C. lower over Oklahoma City, Okla., than that which was recorded over Fargo, N. Dak.

The lowest mean free-air temperature recorded in the high altitudes by means of radiosonde was −72.2° C. over Washington, D. C., at 17 kilometers. But, in the lower levels below 5 kilometers, where observations are made by both radiosonde and airplane, the lowest mean temperatures for the country during the current month were recorded over Fargo, N. Dak. These temperatures, for each level from 0.5 to 5 kilometers, respectively, were −4.7° C., −5.3° C., −5.7° C., −6.9° C., −9.1° C., −11.7° C., −17.0° C., and −22.8° C. The highest mean temperatures recorded in each level for the month were: 13.9° C., 13.2° C., 11.4° C., 9.6° C., 7.7° C., and 5.5° C., over San Diego, Calif., and 0.1° C., and −5.7° C., over Pensacola, Fla.; all recorded at 0.5, 1, 1.5, 2, 2.5, 3, 4, and 5 kilometers, respectively. Below-zero mean temperatures were reported from all stations at 5 kilometers and higher, and at Fargo, N. Dak., and Sault Ste. Marie, Mich., at all levels beginning with that at 0.5 kilometer.

During November the mean temperatures observed at all stations were lower than in the preceding month of October. Such seasonal changes were decidedly outstanding at Fargo, N. Dak., Sault Ste. Marie, Mich., Salt Lake City, Utah, Billings, Mont., Omaha, Nebr., and Oklahoma City, Okla. But, on the other hand, at Lakehurst, N. J., San Diego, Calif., Norfolk, Va., and Oakland, Calif., the November mean temperatures were very little lower than in October. At Fargo, N. Dak., the mean temperatures for November were lower than in October by 15.1° C., 15.8° C., 14.5° C., 13.9° C., 13.7° C., 13.4° C., 12.4° C., and 11.4° C.; but over San Diego, Calif., they differed only by 1.3° C., 2.1° C., 2.7° C., 1.1° C., 1.3° C., 0.0° C., 0.2° C., and 1.0° C.; at 0.5, 1, 1.5, 2, 2.5, 3, 4, and 5 kilometers, respectively.

The distribution of atmospheric pressure during the month of November was remarkably uniform. Isobaric charts, which were prepared from the mean pressure data given in tables 1 and 1a, showed that a well-defined area of low pressure existed over the north-central States at all levels up to 5 kilometers. Its statistical center was over Fargo, N. Dak., reaching as high as 16 kilometers. Above this altitude the center spread out to include Sault Ste. Marie, Mich., and Omaha, Nebr. Higher pressures prevailed over the South, and particularly so at Pensacola, Fla., up to 5 kilometers. Then, above that level, the highest pressures were found over Nashville, Tenn., where radiosonde observations are made. They continued upward to the maximum altitude reached during the month—20 kilometers.

The differences in pressure existing between the centers of low and high pressure at each level over Fargo, N. Dak.,

and Pensacola, Fla., respectively, were found to increase steadily with altitude. They were: 8, 12, 15, 17, 18, 20, 21, and 25 millibars, at 0.5, 1, 1.5, 2, 2.5, 3, 4, and 5 kilometers, respectively. Mean free-air pressures along the Atlantic and Pacific coasts were nearly the same at each level, being only slightly lower than the pressures over Pensacola. The November mean pressures in the low area over Fargo, N. Dak., and Sault Ste. Marie, Mich., were considerably less than those recorded in the preceding month of October. But over the southern States only a slight negative difference was noted in the higher pressures that were recorded.

High percentages of mean relative humidity were found also over Fargo, N. Dak., where the lowest temperatures and lowest pressures in the country were centered during November. These humidities varied from 85 percent at 0.5 kilometer, to 63 percent at 5 kilometers. Humidity also was relatively high over the northern Rocky Mountain region. The driest air of the month occurred over El Paso, Tex., upward to 3 kilometers, and then over Pensacola, Fla., up to 5 kilometers, inclusive, where it was only 20 percent. In the lower levels the humidity ranged higher along the Atlantic coast than on the Pacific, but above 2.5 kilometers the Pacific coast humidity became slightly higher. The mean relative humidity recorded at all levels, like the temperature and pressure, was more evenly distributed in November than during the preceding month of October, or in the previous months of spring and summer. During November the humidity over the portion of the country along the Gulf and southern border was lower than in the preceding month, but elsewhere the differences were not so pronounced.

Resultant winds in the free atmosphere, based on pilot-balloon observations made near 5 a. m. (75th meridian time), are shown in table 2. The distribution or flow of upper-air winds during the current month of November was more stream-lined than in October. Except for several stations that showed outstanding tendencies, the resultant wind directions for November were generally quite normal. In each level the wind directions that departed widely from normal were indicated by their November resultants of: 179° at Atlanta, Ga.; 179°, 220°, and 234° at Pensacola, Fla.; 283° at Salt Lake City, Utah; 67° at Key West, Fla.; 343° at Medford, Oreg.; and 332° at Salt Lake City, Utah; as compared to their normals of 326°, 341°, 311°, 310°, 191°, 5°, 307°, and 301°; at 0.5, 1, 1.5, 2, 2.5, 3, 4, and 5 kilometers, respectively.

In each level there were resultant wind directions that actually became normal or very nearly so. The stations reporting these conditions, with the amount of departure given in degrees, are: Oakland, Calif., (2°) with the current direction rotated counterclockwise away from its normal, at 0.5 kilometer; Fargo, N. Dak., (0°) at 1, 1.5, and 2 kilometers; Washington, D. C., (3°) rotated counterclockwise, at 2.5 kilometers; and Albuquerque, N. Mex., (0°) at 3, 4, and 5 kilometers, inclusive.

Wind directions in the Southeast, especially over Pensacola, Fla., showed the largest departures from normal for the month. The differences (in degrees) between these directions and their normals were: 36° (when rotated clockwise from normal); 162°, 91°, 76°, 38°, and 48° (all rotated counterclockwise); at 0.5, 1, 1.5, 2, 2.5, and 3 kilometers, respectively. Resultant directions at Atlanta, Ga., also showed marked departures. The differences were: 147°, 47°, 33°, 30°, 22°, 15°, and 24° (all rotated counterclockwise); at 0.5, 1, 1.5, 2, 2.5, 3, and 4 kilometers, respectively. At Key West, Fla., too, departures from normal were large. But, at all levels above 0.5 kilometer, the departures were in opposite directions to those noted at Atlanta, Ga., and Pensacola, Fla.

The differences at Key West, Fla., were: 13°, 17°, 45°, 69°, 63°, and 27° (with the current direction being rotated clockwise from normal), at all levels from 1 to 4 kilometers, inclusive. At Sault Ste. Marie, Mich., the current wind direction departures were all counterclockwise, and they differed from their normals by as much as 50°, 40°, 24°, 39°, 45°, and 44°, at the surface, and 0.5, 1, 1.5, 2, and 2.5 kilometers, respectively. But at Albuquerque, N. Mex., Billings, Mont., Boston, Mass., Oklahoma City, Okla., Seattle, Wash., Chicago, Ill., Brooklyn, N. Y., Fargo, N. Dak., Omaha, Nebr., and St. Louis, Mo., in the order given, the resultant wind directions showed slight and unimportant departures from normal at all levels.

It is interesting to note that practically all departures of resultant wind directions from normal in the upper air showed tendencies to turn somewhat south of normal, with the monthly resultant being rotated away from normal in a counterclockwise direction. These conditions were noted at the surface and all levels over Brooklyn, N. Y., Boston, Mass., Cincinnati, Ohio, St. Louis, Mo., Chicago, Ill., Nashville, Tenn., Detroit, Mich., Sault Ste. Marie, Mich., and Albuquerque, N. Mex. Some stations showed similar departures in the free-air but not at the surface (where clockwise departures prevailed).

Stations showing the latter tendencies were: Washington, D. C., Pensacola, Fla., Fargo, N. Dak., Omaha, Nebr., Atlanta, Ga., and Oklahoma City, Okla. Key West, Fla., was the only station reporting clockwise departures at all levels, as mentioned above, while Salt Lake City, Utah, and Oakland, Calif., Medford, Oreg., Seattle, Wash., and Spokane, Wash. (all Pacific coast points) had similar departures in the higher levels only. Of these coastal stations, the latter three show decidedly southerly resultant wind directions, both normally and for the current month, while those at Oakland and San Diego, Calif.—farther south along the coast—had normal and current directions that are nearly north.

The distribution of resultant wind directions over the United States at all upper-air levels during November showed that westerly winds predominated. At 0.5 kilometer 69 percent of all the winds had westerly components, and this increased steadily to 96 percent at 2.5 kilometers and 100 percent at 4 and 5 kilometers. Of all the westerly winds the larger percentage in the lower levels had southwesterly components. This ranged from 75 percent at 1.5 kilometers to 11 percent at 4 kilometers. Practically all of the winds with easterly components fell within the southeast quadrant. The large percentage of winds having southwesterly directions accounts for the large number of departures from normal that were south of, or in a counterclockwise rotation from, normal. The average departure in each level above the surface, for all stations, was about 20°, and 69 percent of these were counterclockwise, or generally south of normal.

Resultant wind velocities for November showed rather light departures from normal velocities at nearly all stations. The largest departures from normal in each level occurred at Nashville, Tenn. (+1.3 and +3.2 m. p. s.); Sault Ste. Marie, Mich. (+3.9, +4.3, +3.6, and +3.2); Cincinnati, Ohio (+3.5) and Pensacola, Fla. (−3.5); Atlanta, Ga. (−5.6); and Salt Lake City, Utah (+3.6); at the surface, and 0.5, 1, 1.5, 2, 2.5, 3, 4, and 5 kilometers, respectively.

At Sault Ste. Marie, Mich., the largest velocity departures were recorded. In the lower levels—1, 1.5, 2, and 2.5 kilometers—the resultant velocities showed positive

departures of from 3 to 4 meters per second. But, at Fargo, N. Dak., where large departures in wind direction were noted, the velocity variations from normal were slight—averaging only about 0.5 m. p. s. Spokane, Wash., and Medford, Oreg., also had very slight departures from normal velocities except at the 4-kilometer level. At Cheyenne, Wyo., however, the wind velocities were nearly normal at all levels and with no departures whatever at two of the levels. Greater-than-normal or positive velocity departures occurred at all levels over Billings, Mont., Chicago, Ill., Cincinnati, Ohio, Detroit, Mich., Key West, Fla., Nashville, Tenn., Sault Ste. Marie, Mich., and Oklahoma City, Okla., while negative departures were found only at Atlanta, Ga., and Washington, D. C.

Table 3 shows the maximum free-air velocities for different sections of the United States that occurred between the surface and 2.5 kilometers, 2.5 kilometers and 5 kilometers, and above 5 kilometers. A number of these high-altitude observations were made with the new 100-gram balloons. These have higher ascensional rates and reach greater elevations. The month of November 1938 was characterized by extremely high wind velocities in the upper air. At Winslow, Ariz., on the 14th, a velocity of 90 meters per second (202 miles per hour) from the WSW, was recorded at 12 kilometers. It appears that this is a record for the country, exceeding that of 81 m. p. s. established at Lansing, Mich., at 6 kilometers, in December 1919. The Winslow observation was made with the 100-gram balloon at the end of 37 minutes by means of a single theodolite. But while this velocity is unusually high, it agrees closely with similar records obtained at surrounding stations on the same and adjoining dates.

Further high velocities above 5 kilometers were noted over Modena, Utah (66 m. p. s. at 17 kilometers), which exceeded the previous record of 58 m. p. s.; and over Fargo, N. Dak. (62 m. p. s. at 8.5 kilometers), which also surpassed the record established at that station. Maximum wind velocities also occurred at Medford, Oreg. (57.6 m. p. s. at 9.8 kilometers); Nashville, Tenn. (50 m. p. s. at 8.2 kilometers); Wichita, Kans. (57.6 m. p. s. at 9.5 kilometers); and Oklahoma City, Okla. (55 m. p. s. at 7.6 kilometers). These wind speeds also exceeded the previous all-time records.

In the levels below 5 kilometers extremely high wind velocities were the rule during November. Washington, D. C., recorded 69.1 meters per second (155 miles per hour) from the WNW on the 14th at only 2.6 kilometers above the surface. This surpassed a previous record of 41 m. p. s. made at 10 kilometers. High wind speeds, some of them record breaking, occurred in each section of the country at the lower levels, as shown in table 3, and ranged from 32 to 56 m. p. s. below 2.5 kilometers, and from 44 to 69 m. p. s. between 2.5 and 5 kilometers.

TABLE 1.—*Mean free-air barometric pressures (P) in mb, temperatures (T) in °C., and relative humidities (R. H.) in percent obtained by air planes during November 1938*

Stations and elevations in meters above sea level	Altitude (meters) m. s. l.																										
	Surface				500			1,000			1,500			2,000			2,500			3,000			4,000			5,000		
	No. of obs.	P	T	R. H.	P	T	R. H.	P	T	R. H.	P	T	R. H.	P	T	R. H.	P	T	R. H.	P	T	R. H.	P	T	R. H.	P	T	R. H.
Billings, Mont. (1090 m)	29	891	−0.4	67	----	----	----	----	----	----	847	+0.7	58	796	−1.9	58	747	−5.2	59	700	−8.6	60	615	−14.7	60	538	−21.5	60
Cheyenne, Wyo. (1873 m)	30	809	−2.4	62	----	----	----	----	----	----	----	----	----	796	−.6	57	748	−2.3	54	702	−5.5	53	617	−11.5	52	541	−18.3	51
Chicago, Ill. (187 m)	29	994	3.4	74	956	4.6	68	900	3.6	64	846	1.5	62	794	−.4	58	746	−2.7	56	701	−5.2	56	616	−11.3	58	540	−16.5	56
Coco Solo, C. Z [1] (15 m)	26	1009	24.5	93	954	23.0	87	902	20.3	86	850	17.8	81	802	15.7	77	756	13.3	75	712	10.8	72	631	5.2	71	558	−.1	58
El Paso, Tex. (1193 m)	30	884	3.8	36	----	----	----	----	----	----	852	8.4	34	802	6.7	32	754	4.9	30	709	2.3	29	626	−2.7	25	551	−8.6	23
Lakehurst, N. J.[1] (39 m)	24	1017	7.3	87	961	10.4	66	905	8.1	66	852	6.6	62	801	4.8	52	753	3.1	44	708	0.0	43	624	−6.0	41	----	----	----
Norfolk, Va.[1] (10 m)	18	1023	9.5	91	965	10.8	72	909	8.3	66	856	7.2	60	805	5.3	55	757	4.0	45	711	1.5	41	628	−4.0	36	552	−10.6	33
Pearl Harbor, T. H.[1] (6 m)	30	1015	22.1	78	959	21.8	70	905	18.7	76	854	15.8	78	805	14.5	63	758	14.1	41	715	12.2	34	634	7.8	26	561	2.9	28
Pensacola, Fla.[1] (13 m)	28	1021	11.6	86	962	13.2	71	907	11.6	66	855	10.2	58	805	8.7	51	757	7.3	38	712	5.4	30	628	.1	23	555	−5.7	20
St. Thomas, V. I.[1] (8 m)	29	1014	26.7	78	958	23.4	86	905	20.3	87	854	17.7	80	805	14.9	77	759	12.6	69	715	10.4	61	634	5.4	49	560	.1	41
Salt Lake City, Utah (1288 m)	30	876	−2.6	82	----	----	----	----	----	----	853	−.6	66	801	−2.1	60	752	−4.7	59	705	−7.6	60	620	−11.7	54	543	−18.1	52
San Diego, Calif.[1] (10 m)	30	1017	8.8	75	959	13.9	63	904	13.2	53	851	11.4	47	802	9.6	41	754	7.7	37	709	5.5	35	627	0.0	31	553	−6.6	29
Seattle, Wash.[1] (10 m)	17	1022	6.1	80	963	6.5	70	906	5.0	64	852	2.9	61	801	.8	56	752	−1.8	54	706	−4.5	54	621	−10.9	55	----	----	----
Spokane, Wash. (597 m)	30	950	−.7	86	----	----	----	904	.2	75	849	−1.2	66	797	−3.8	64	748	−6.1	65	701	−8.7	64	610	−13.7	61	539	−19.3	61

[1] Navy.
Observations taken about 4 a. m. 75th meridian time, except by Navy stations along the Pacific coast and Hawaii where they are taken at dawn.

NOTE.—None of the means included in this table are based on less than 15 surface or 5 standard-level observations.

TABLE 1a.—*Mean free-air barometric pressures (P) in mb, temperatures (T) in °C., and relative humidities (R. H.) in percent obtained by radiometeorographs during November 1938*

Altitude (meters) m. s. l.	Fargo, N. Dak. (274 m)				Nashville, Tenn. (180 m)				Oakland, Calif. (2 m)				Oklahoma City, Okla. (391 m)				Omaha, Nebr. (300 m)				Sault Ste. Marie, Mich. (221 m)				Washington, D. C.[1] (13 m)			
	Number of obs.	P	T	R H	Number of obs.	P	T	R H	Number of obs.	P	T	R H	Number of obs.	P	T	R H	Number of obs.	P	T	R H	Number of obs.	P	T	R H	Number of obs.	P	T	R H
Surface	30	982	−6.5	84	30	999	6.3	78	30	1,021	7.7	73	29	972	4.3	68	30	980	0.8	74	30	987	−0.1	87	29	1,022	6.1	83
500	30	954	−4.7	85	30	961	8.8	68	30	962	10.6	63	29	959	5.5	66	30	957	2.1	67	30	954	−.2	88	29	962	6.8	71
1,000	30	895	−5.3	82	30	904	6.9	63	30	905	9.2	57	29	902	6.5	58	30	899	2.5	63	30	896	−1.1	85	29	905	5.5	68
1,500	30	840	−5.7	77	30	851	4.9	57	30	852	7.5	52	29	849	6.2	50	30	845	1.3	59	30	841	−2.8	79	29	851	4.0	67
2,000	30	788	−6.9	72	30	800	3.6	54	30	802	5.9	47	29	799	4.5	46	30	794	−.5	55	30	789	−5.2	77	29	800	2.4	65
2,500	30	739	−9.1	69	30	752	2.1	53	30	754	3.8	45	29	751	2.7	43	30	745	−2.9	52	30	740	−7.6	75	29	751	0.9	58
3,000	30	692	−11.7	68	29	707	0.5	45	29	709	1.6	43	29	706	.3	40	30	700	−5.5	52	30	694	−10.3	73	29	705	−.9	53
4,000	30	607	−17.0	67	29	624	−3.9	35	29	625	−4.0	42	29	622	−5.0	37	28	615	−10.9	52	30	608	−15.4	68	29	622	−5.9	47
5,000	30	530	−22.8	63	29	549	−9.8	32	29	550	−9.7	41	27	548	−10.9	34	28	539	−16.5	49	30	532	−21.0	63	29	546	−11.8	43
6,000	30	462	−29.4	61	29	481	−15.9	32	29	483	−16.2	40	26	480	−17.3	33	26	471	−22.9	47	30	464	−27.0	59	28	478	−18.0	42
7,000	30	400	−35.8	59	29	421	−22.7	30	29	422	−23.2	39	25	420	−24.4	32	26	410	−29.5	46	30	403	−33.5	58	25	418	−24.6	42
8,000	29	346	−42.2	58	29	366	−29.8	29	29	367	−30.6	38	25	365	−31.2	32	25	356	−36.2	46	30	349	−39.8	58	24	364	−31.2	37
9,000	29	298	−48.0	----	29	317	−36.5	29	29	318	−37.8	38	25	317	−37.7	32	23	308	−42.9	----	29	301	−45.9	----	24	316	−38.0	----
10,000	29	256	−51.5	----	29	274	−42.9	29	29	275	−44.7	----	25	274	−44.5	----	20	265	−48.9	----	29	259	−50.3	----	23	272	−44.4	----
11,000	29	219	−53.5	----	29	236	−48.5	----	25	236	−50.6	----	25	235	−50.9	----	18	227	−53.1	----	29	222	−53.4	----	21	234	−49.8	----
12,000	28	188	−53.1	----	27	203	−52.2	----	25	202	−54.4	----	23	202	−54.8	----	17	193	−56.7	----	29	190	−54.6	----	17	200	−54.3	----
13,000	26	161	−53.6	----	25	173	−56.1	----	23	172	−56.7	----	20	172	−58.2	----	16	165	−57.2	----	27	162	−55.4	----	14	171	−58.5	----
14,000	24	137	−54.7	----	25	148	−58.8	----	19	147	−58.9	----	17	147	−61.8	----	15	140	−58.5	----	24	138	−56.6	----	12	145	−62.2	----
15,000	23	117	−55.9	----	23	126	−61.2	----	19	125	−60.8	----	14	125	−65.0	----	14	119	−60.2	----	20	118	−59.3	----	11	123	−66.4	----
16,000	23	100	−56.9	----	22	107	−63.5	----	19	106	−62.3	----	11	106	−67.5	----	13	101	−60.6	----	18	101	−58.1	----	9	103	−69.8	----
17,000	18	85	−57.4	----	18	91	−64.6	----	18	90	−62.9	----	9	89	−70.4	----	11	86	−61.2	----	15	86	−58.7	----	7	86	−72.2	----
18,000	16	72	−57.5	----	14	77	−64.6	----	12	76	−63.0	----	8	75	−68.5	----	8	72	−60.4	----	13	73	−59.3	----	------	------	------	----
19,000	11	62	−57.7	----	13	65	−63.5	----	9	65	−62.2	----	6	63	−65.5	----	6	61	−60.1	----	8	62	−59.9	----	------	------	------	----
20,000	6	52	−57.7	----	9	55	−61.1	----	------	------	------	----	------	------	------	----	------	------	------	----	6	53	−60.2	----	------	------	------	----

[1] Navy.

Observations taken about 4 a. m. 75th meridian time, except by Navy stations along the Pacific coast and Hawaii where they are taken at dawn.

NOTE.—None of the means included in this table are based on less than 15 surface or 5 standard-level observations.

Number of observations refers to pressure only as temperature and humidity data are missing for some observations at certain levels also the humidity data is not used in daily observations when the temperature is below −40° C.

TABLE 2.—*Free-air resultant winds (meters per second) based on pilot-balloon observations made near 5 a. m. (E. S. T.) during November 1938*

[Wind from N=360°, E=90°, etc.]

Altitude (meters) m. s. l.	Albuquerque, N. Mex. (1,554 m)		Atlanta, Ga. (302 m)		Billings, Mont. (1,095 m)		Boston, Mass. (15 m)		Brooklyn, N. Y. (15 m)		Cheyenne, Wyo. (1,873 m)		Chicago, Ill. (192 m)		Cincinnati, Ohio (157m)		Detroit, Mich. (204 m)		Fargo, N. Dak. (283 m.)		Houston, Tex. (21 m)		Key West, Fla. (11 m)		Medford, Oreg. (410 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	317	1.7	357	1.1	264	3.9	276	2.3	272	1.5	285	5.0	224	2.4	177	0.7	216	3.5	300	0.9	63	0.8	58	3.6	156	0.6
500	------	------	179	.6	------	------	272	6.3	269	4.5	------	------	236	8.3	217	6.4	236	8.8	309	3.6	167	3.1	80	7.9	158	.7
1,000	------	------	256	1.6	------	------	272	6.8	266	6.9	------	------	247	11.5	243	9.9	242	11.0	307	6.8	214	3.3	92	6.2	154	1.2
1,500	------	------	257	3.7	275	11.0	270	9.1	258	9.2	------	------	255	12.6	253	9.5	257	10.5	297	8.7	260	3.3	101	4.6	190	2.1
2,000	296	3.3	261	6.0	297	11.0	271	9.3	267	9.4	282	6.8	257	12.9	267	11.7	262	11.7	297	10.9	251	4.6	107	3.7	265	2.0
2,500	284	5.4	264	6.5	302	11.2	278	10.0	273	10.8	285	11.1	275	12.9	258	11.5	262	11.0	291	12.3	268	6.0	108	2.2	290	4.2
3,000	284	8.2	265	6.9	300	12.3	273	11.6	268	10.6	290	10.8	------	------	250	12.3	257	10.4	292	11.0	273	7.4	67	2.4	320	5.2
4,000	283	12.5	260	4.0	299	10.2	------	------	------	------	290	10.0	------	------	------	------	------	------	------	------	262	8.5	326	1.4	343	8.0
5,000	289	10.7	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

Altitude (meters) m. s. l.	Nashville, Tenn. (194 m)		Oakland, Calif. (3 m)		Oklahoma City, Okla. (402 m)		Omaha, Nebr. (306 m)		Pearl Harbor, Territory of Hawaii [1] (68 m)		Pensacola, Fla.[1] (24 m)		St. Louis, Mo. (170 m)		Salt Lake City, Utah (1,294 m)		San Diego, Calif. (15 m)		Sault Ste. Marie, Mich. (198 m)		Seattle, Wash. (14 m)		Spokane, Wash. (603 m)		Washington, D. C. (3 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	182	2.4	58	0.3	209	1.6	237	0.5	------	------	54	3.1	210	2.5	146	1.9	33	0.5	145	1.1	151	1.0	209	1.2	309	1.3
500	211	6.5	11	3.1	207	4.5	284	2.9	------	------	97	3.5	243	7.4	------	------	353	1.0	216	4.3	172	3.5	------	------	262	4.8
1,000	227	8.0	4	3.7	243	8.2	281	6.6	------	------	179	1.4	253	9.5	------	------	359	1.5	245	8.7	188	1.6	226	3.1	261	5.2
1,500	233	7.7	342	2.7	262	6.7	287	7.7	------	------	220	2.5	266	9.9	175	2.3	312	1.7	244	10.5	220	1.8	256	4.9	261	7.3
2,000	245	8.3	343	3.5	261	8.4	282	7.9	------	------	234	3.5	262	10.6	219	1.7	287	2.6	238	10.5	269	3.2	258	6.1	262	8.6
2,500	263	9.8	343	3.8	261	8.9	286	9.4	------	------	264	2.3	262	11.7	283	3.5	303	3.8	250	11.7	256	4.6	278	6.2	272	8.3
3,000	262	10.9	335	4.3	279	10.3	281	11.4	------	------	256	3.3	272	10.8	299	5.6	309	5.1	------	------	284	4.2	297	7.0	267	11.7
4,000	254	10.9	307	4.5	260	11.8	277	12.0	------	------	------	------	277	7.9	313	9.4	310	5.3	------	------	------	------	290	5.1	------	------
5,000	------	------	288	3.0	------	------	------	------	------	------	------	------	------	------	332	11.4	290	6.2	------	------	------	------	336	7.8	------	------

[1] Navy stations.

TABLE 3.—*Maximum free-air wind velocities (m. p. s.) for different sections of the United States, based on pilot-balloon observations during November 1938*

Section	Surface to 2,500 meters (m. s. l.)					Between 2,500 and 5,000 meters (m. s. l.)					Above 5,000 meters (m. s. l.)				
	Maximum velocity	Direction	Altitude (m), m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m), m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m), m. s. l.	Date	Station
Northeast [1]	45.3	W	1,940	13	Cleveland, Ohio	44.2	W	3,040	13	Cleveland, Ohio	43.2	W	5,800	20	Syracuse, N. Y.
East-Central [2]	55.8	WNW	2,500	14	Washington, D. C.	69.1	WNW	2,620	14	Washington, D. C.	50.0	WSW	8,200	22	Nashville, Tenn.
Southeast [3]	30.5	NNW	1,780	24	Spartanburg, S. C.	44.4	WSW	4,350	26	Atlanta, Ga.	48.8	WSW	6,150	25	Atlanta, Ga.
North-Central [4]	49.1	W	820	14	Detroit, Mich.	47.0	W	2,630	13	Detroit, Mich.	62.0	SW	8,570	3	Fargo, N. Dak.
Central [5]	43.0	SSE	2,080	12	Chicago, Ill.	46.0	SW	5,000	12	Wichita, Kans.	57.6	WSW	9,560	5	Wichita, Kans.
South-Central [6]	38.0	NNW	2,470	24	Ft. Worth, Tex.	48.0	WNW	4,630	7	Abilene, Tex.	55.0	WSW	7,570	13	Oklahoma City, Okla.
Northwest [7]	35.8	W	1,940	15	Havre, Mont.	44.2	N	4,820	18	Medford, Oreg.	57.6	NNW	9,820	5	Medford, Oreg.
West-Central [8]	32.2	WNW	2,480	30	Cheyenne, Wyo.	51.8	WSW	4,320	8	Reno, Nev.	66.0	NNW	6,430	17	Modena, Utah.
Southwest [9]	34.7	NNW	2,110	2	Burbank, Calif.	51.5	W	5,000	1	Las Vegas, Nev.	90.0	WSW	12,020	14	Winslow, Ariz.

[1] Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, and northern Ohio.
[2] Delaware, Maryland, Virginia, West Virginia, southern Ohio, Kentucky, eastern Tennessee, and North Carolina.
[3] South Carolina, Georgia, Florida, and Alabama.
[4] Michigan, Wisconsin, Minnesota, North Dakota, and South Dakota.
[5] Indiana, Illinois, Iowa, Nebraska, Kansas, and Missouri.
[6] Mississippi, Arkansas, Louisiana, Oklahoma, Texas (except El Paso), and western Tennessee.
[7] Montana, Idaho, Washington, and Oregon.
[8] Wyoming, Colorado, Utah, northern Nevada, and northern California.
[9] Southern California, southern Nevada, Arizona, New Mexico, and extreme west Texas.

RIVERS AND FLOODS

[River and Flood Division, MERRILL BERNARD in charge]

By BENNETT SWENSON

No floods occurred during November 1938 with the exception of a flood in the Chippewa River from the 6th to the 9th. This flood resulted from heavy rainfall during the first week of November averaging more than 3 inches over the basin. The river crested at Durand, Wis., at 4 p. m. of the 7th with a stage of 13.0 feet, 2 feet above flood stage. The damage caused by this overflow is estimated at about $5,000.

WEATHER ON THE ATLANTIC AND PACIFIC OCEANS

[The Marine Division, I. R. TANNEHILL in charge]

NORTH ATLANTIC OCEAN, NOVEMBER 1938

By H. C. HUNTER

Atmospheric pressure.—Pressure averaged much lower than normal over north-central and northeastern regions, the mean at Reykjavik, Iceland, being 0.4 inch less than the normal. The center of the Icelandic low-pressure area lay to the eastward of the average November location. The southeastern area averaged above normal pressure, with notably high readings constantly from the 12th onward to the end of the month. At the Azores, pressure averaged about normal, low readings from the 3d to the 14th being balanced by higher readings after the latter date.

The western North Atlantic had pressure moderately above normal to northward of latitude 30°, but over the Greater Antilles pressure averaged a little below normal, the first 12 days of the month being marked by readings quite low for the latitude.

The extremes of pressure among dependable vessel reports at hand are 30.71 and 28.40 inches. The higher reading was recorded not far to southwestward of the western Azores during the forenoon of the 28th by the Dutch steamship *Amsterdam*. The low mark was noted on the American steamship *Black Gull*, about 4 p. m. of the 11th, close to 49° N., 37° W.

Table 1 shows that the island station at Reykjavik had pressure slightly lower than the low mark mentioned, the date of occurrence being the 27th. Furthermore, a reading of 28.10 inches, uncorrected, has been reported from the North Sea, not far from Tynemouth, England, noted during the 23d on the British steamship *Lunula*.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure (sea level) at selected stations for the North Atlantic Ocean and its shores, November 1938*

Station	Average pressure	Departure	Highest	Date	Lowest	Date
	Inches	*Inch*	*Inches*		*Inches*	
Julianehaab, Greenland	29.41	−0.15	30.00	6	28.72	15
Reykjavik, Iceland	29.22	−.40	29.86	9	28.38	27
Lerwick, Shetland Islands	29.38	−.32	30.33	15	28.50	1
Valencia, Ireland	29.66	−.23	30.18	15	28.73	23
Lisbon, Portugal	30.21	+.17	30.45	17	29.77	10
Madeira	30.14	+.13	30.36	29	29.80	8
Horta, Azores	30.15	+.02	30.58	28	29.38	9
Belle Isle, Newfoundland	29.83	+.06	30.36	27	28.90	14
Halifax, Nova Scotia	30.08	+.13	30.62	26	29.26	27
Nantucket	30.12	+.07	30.57	3	29.15	25
Hatteras	30.18	+.07	30.47	29	29.59	24
Bermuda	30.17	+.09	30.36	6	29.98	1
Turks Island	29.95	−.04	30.10	14	29.71	7
Key West	30.01	−.01	30.26	28	29.74	8
New Orleans	30.15	+.05	30.62	28	29.77	18

NOTE.—All data based on a. m. observations only with departures compiled from best available normals related to time of observation, except Hatteras, Key West, Nantucket, and New Orleans, which are 24-hour corrected means.

Cyclones and gales.—November lived up to its reputation for being a stormy month over the North Atlantic. While most of the reports of winds of very great force come from northern waters east of the 50th meridian, yet there are interesting features to be noted of cyclones that occurred near American or West Indian shores.